DESIGN AND FABRICATION OF MECHANICAL DEVICE FOR LIFTING CHILD FROM BORE WELL

M. Sai Teja[1], P.V. Kalyan Sreenivas[2], N.S.V.S Arun Kumar[3], M.V. Sri Ram Kumar[4]

[1,2,3,4] *B.E Students, Department of Mechanical Engineering, SRM Institution of Science and Technology, Ramapuram, Chennai, India*

Abstract - *As we are seeing from many years children have been falling into bore-well which was dug to fetch water but left as it is when not getting water. The bore-well owner/digger don't take any safety precaution for covering those bore-wells. Rescuing children from such situation is not an easy task as it takes hours of time and human effort to do so. There are several incidents of children falling into bore-wells in the recent past. And their parents started to search for rescue services. Today, with the help of technology we develop lot of instruments/devices which consists of sensors, actuators, mechanisms to save the children. But this technology can be adopted by the person one who knows the operation? How it works? This technology is not suitable for the village areas where most people are unknown to new technologies. So, our aim is to construct a simple and easily operable mechanical device to lift a child from the bore-well. We use high definition camera to visualize child condition from PC and operate air bag to lift the child. Then, by the help of automated lifting system, the child is rescued from bore-well. For automation, light weight geared motors are used which give slow speed but greater torque which is run by DC battery and are controlled by toggle switches.*

Key Words*: *air bag, robot rescuing machine, hd camera, child rescued from bore well, bevel gear, pneumatic cylinder

1. INTRODUCTION

At present context, clean water scarcities are leading for construction of underground bore-wells to get water. And the number of bore-wells are increasing day by day. If there is no availability of water in the bore-well then it is left as it is by the constructors in most cases, which is the reason why those life taking bore-wells exist. In other cases, children unaware of such bores, and children playing carelessly around such uncovered bore-wells become its victim.

There is no proper equipment available for handling rescue operation. Usually, conventional method i.e., parallel digging is used to rescue the child from bore-wells. It takes a lot of time and resources to perform such operation. In most cases, the child is found dead, because of long operation time and falling of foreign materials on the child which harms the child breathing.

In the world of technological advancement, we can ease our work by creating machines and equipment according to our requirement. Man has created from simple machines such as lever, pulley to complex robots and spacecraft. As we can find variety of materials and components in the market to create our own machine, why not create a rescuing device that can lift a trapped child out of bore-well. So we have built a device that is simple in making, easily operable and takes less energy for operation.

We have designed a light weight device so that it can be transported from one place to another easily due to the fact that there may be trapped victims at different locations at different time. This device can overcome the difficulties of adopting parallel digging, such as more time consumption, more rescue personnel, and yet very less chance of success in saving child's life.

2. BLOCK DIAGRAM

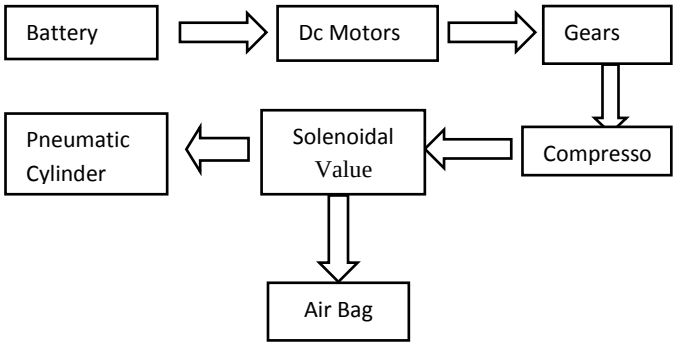

Fig-1: Block diagram

3. DESIGN CONCEPT

In this we have a frame consists of a rolling rod over it where we can bind the rope and in turn connected to the small hole in machine and so we can get machine inside the hole.

Then there are two discs on one of it has a bevel gear arrangement where it helps us to fit the machine at one position to down of that we have a spur gear attachment which is connected to other disk which consists of the pneumatic cylinder for the pneumatic cylinder we connected the air bag.

The spur gear arrangement is used to change the pneumatics position in circular position so that we can send the piston rod below the child and fill air to airbag so that we can lift the baby.

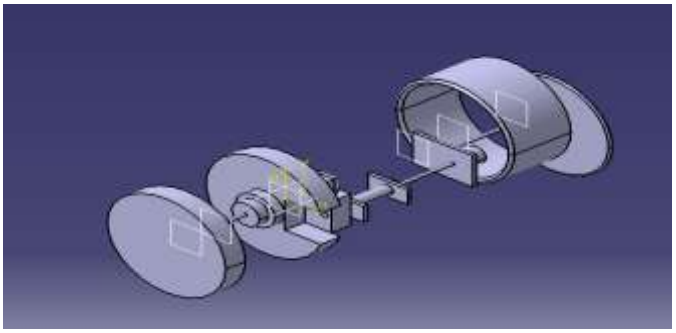

Fig -2: Design concept

3.1 Working

Firstly we should roll all the rope over the rod pivoted in the frame then we should tie the rope to machine with the lever presented side of the frame so that we can control the motion of the machine.

Now we discuss about the working of the machine itself. As it go deeper we can visualize the position of the child with respect to the position we can stop the machine at the required height and lock it with help of bevel gear and screw mechanisms. After the lock we should adjust the position of the pneumatic cylinder with help of spur gear arrangement and then after arranging the cylinder with help of solenoidal value we actuate the cylinder and fill the air bag after the air bag is filled the baby can conveniently sit on the bag and then by reversing the positive and negative of the battery the lock gets opened. So by using the lever we can lift the machine slowly and get out of the well. So by these we can save the life of the child.

4. FABRICATION

We used many tools to fabricate the below tabulation shows it.

Table -1: Components Used

S.No	Materials	Quantity
1	Screw Rod	1
2	Rope	1
3	Dc Motor	2
4	Disc	2
5	Air Bag	1
6	Air Compression Tank	1
7	Tube	1
8	Nut Set	2
9	Rope Roller	1

4.1 D.C Motor

There are 2 dc motors used in this system. One to rotate the bevel gear, and one to operate the spur gear. The disc has dc motor of 12V which rotates with 30 rpm and spur gear has a motor of 12V and 10 rpm.

Fig -3: D.C Motor

4.2 Disc

The disc here is used to position the camera such that the position of the child can be examined. One disc of made of mild steel and other is aluminum alloy. There are total 2 discs used in this arrangement placed vertically parallel with a gap of 3.5 cm between them. The discs are of dimension 11 inch diameter and 6 mm thickness separately. The upper disc is fixed with the wiring tied with the string coming through pulley and also consists of the whole bevel gear setup.. The lower disc is rotating which is connected to the motor held vertically perpendicular to the disc. We use an external battery to run these motors.

Fig -4: Disc

4.3 Lifting elements

The lifting elements consist of rope, rope roller and automated rope winding shaft. The material of rope is Nylon. There are lot of lifting elements available in the market but they have their own limitations. For example, we could have used chain and sprocket or gear drive as lifting element. But the main problem of chain and sprocket and gear drive is that they are fixed drives. Whereas, rope is flexible enough to be used in short depth as well as long depth as they can be wounded around for lifting and releasing. Moreover, rope is quiet lighter in weight and smaller in cross section than other lifting elements which is very advantageous in our project where size and weight are two major factors.

Fig -5: Rope

4.4 Air bag

It is main component of the project as it is the one which gives the support for lifting the child. So the air that we used is capable of lifting around 50kgs so that as child will be maximum of 10 kg so it is more sufficient

4.5Compressor

Compressor commonly used to increases the pressure by reducing its volume. So we uses the compressor to actuate the pneumatic cylinder and to fill the air in air bag.

Fig -6: Compressor

4.6 Bevel gear

Bevel gear are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well.

Fig -7: Bevel Gear

4.7 Pneumatic cylinder

Pneumatic cylinder(s) (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.

Like hydraulic cylinders, something forces a piston to move in the desire direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage.

Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tiki Room, pneumatics are used to prevent fluid from dripping onto people below the puppets.

Fig -8: Pneumatic cylinder

4.8 Battery

This sealed lead acid battery is ideal for alarm systems, emergency lighting, UPS systems or similar standby applications. When matching the replacement to your existing battery, pay special attention to size and voltage and try to match capacity (AH) as close as possible. We used the 12V battery.

Fig -9: Battery

4.9 Solenoid value

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. We used 3V210-08 model.

Fig -10: Solenoid value

5. PRECAUTION STEPS

When baby accidently felt into the bore-well, first inform to the rescue team in fire station.

The people should not do anything in the bore-well hole.

It will help in preventing foreign bodies entering into the bore well hole like soil, small stones, and wooden pieces. Etc.

The people can help the rescue team by removing obstacles around 5 meter of bore-well without disturbing the bore-well hole as said in previous step.

They must prevent the people entering bore-well area around 10 meter diameter in order to prevent the disturbances during rescue operation.

6. ADVANTAGES

The child can be visualized through the camera which is provided with the arm.
This system is attached with air bag which helps to carry the child from the depth.
It is fully controlled by any one as it is not an automated.
Air bag is strong enough to lift the baby so no point of baby falling down.

7. CONCLUSION

As we discussed above we made a machine that operate at any satiation and can be operated by any people easily. Now it is more convenient way to save a child from bore well with this new design with any programming so that any people even in villages can be aware of them.
In future we can use this project in several applications by adding additional components to this project. By connecting temperature sensor to the robot we can get the temperature of dangerous zones in personal computer itself instead of sending human to there and facing problems at the field, we can send robots to there and sensor will detect the temperature and it gives information to the Microcontroller and microcontroller gives the information to the transceiver from that we can get the data on the PC side. By connecting smoke sensor to the robot we can get the information related concentration of smoke or gases in respective field's i.e (coal mines, dangerous zones, etc.) Sensor sense the information and it gives to the microcontroller and its gives to the transceiver and from that we get the information on personal computer.

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